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Canadian Science Advisory Secretariat
Science Advisory Report 2013/039

ASSESSMENT OF GREENLAND HALIBUT IN THE GULF OF ST. LAWRENCE (4RST) IN 2012

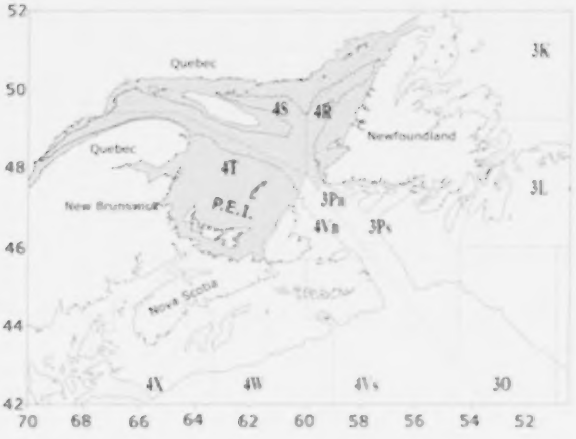

Figure 1. Map of the Gulf of St. Lawrence and neighbouring regions.

Context

Until the mid 1970s, Greenland halibut (commonly called black turbot or turbot) from the Gulf of St. Lawrence (4RST) were not subjected to any directed fishery. At the end of the 1970s, a Greenland halibut fishery developed using gillnets and bottom trawls. Following the closure of the Atlantic cod mobile gear in 1993, any mobile gear directed fishery for Greenland halibut has been prohibited. This fishery is now dominated by boats equipped with gillnets, whose home ports are located in Quebec or on the west coast of Newfoundland.

The fishery is regulated by a number of management measures, including the setting of total allowable catches (TAC). This TAC management limits fishing to protect the population's reproductive potential.

Resource assessment is conducted every two years to highlight changes in the status of the resource justify adjustments to the conservation approach and management plan. The main indicators used for the assessment are taken from fishery statistical data, sampling of commercial catches and research surveys. A science peer review meeting was conducted February 26, 2013 in Mont-Joli, Qc. Participants at the science review were from DFO Science, DFO Fisheries Management, fishing industry, provincial governments, Academia and Aboriginal organisations.

SUMMARY

- Greenland halibut landings reached 3,716 t in 2011 and 3,554 t (preliminary as of December 31) in 2012 out of an allocation of 3,751 t. Fleets can land another 335 t in individual quotas prior to May 15, 2013.
- Fishing sites have changed since 2006. The proportion of catches in the western Gulf has declined from 68% to 37% from 2007 to 2012 while it has increased from 28% to 49% in

Esquiman. During this period, fishing activities have dropped in the Estuary and fisheries have developed around Anticosti (southwest and north). Since 2011, there is no more fishing in southwest Anticosti and there has been a large increase in Esquiman.

- Commercial catch rates in the Gulf of St. Lawrence in 2011 and 2012 were comparable to the series average but lower than those seen between 2007 and 2010. A decline was observed in the western Gulf with values below the series mean in 2011 and 2012. A decline was also observed in Esquiman in 2012 although the catch rate remained high.
- The proportion of females caught in the fishery decreased and is now below the mean since 2010. It is 79% in 2011 and 73% in 2012. This decrease results from the marked decline in 4R from 72% (2005-2010 mean) to 64% in 2011 and 55% in 2012.
- The proportion of individuals in the fishery smaller than 44 cm has remained stable around 7% from 2010 to 2012. At this size, 63% of females and 2% of males were immature. Mean size increased from 2002 to 2011 from 45.1 cm to 49.5 and has remained stable in 2012.
- The size at which 50% of fish are mature has remained stable and generally below the mean since 2001 around 36 cm for males and 46 cm for females.
- The biomass index from the DFO survey has remained stable and above the series mean but has declined slightly since 2007. The biomass index from the Sentinel survey has been constantly declining since 2007 and is below the series average in 2011 and 2012.
- The strong 2004 year-class (with the weak 2003 and 2005 year-classes) dominated the fishery in 2011 and 2012 and contributes to increasing the mean size of the catch.
- Year-classes that should contribute to the fishery in 2013 and 2014 are of average abundance and should maintain current catch level. The strong 2010 year-class will start getting recruited to the fishery in 2015 and should dominate the fishery in 2016.
- Given the values of the main indicators of resource status, the status quo is recommended for the catch levels allowed in 2013 and 2014.

INTRODUCTION

Species Biology

The Greenland halibut population of the Gulf of St. Lawrence is considered to be a stock isolated from the main Northwest Atlantic population found east and north of Newfoundland's Grand Bank. Parasite studies conducted in the early 1990s showed that the Gulf population was distinct, which led to the conclusion that Greenland halibut complete their entire life cycle within the Gulf.

Greenland halibut are generally found in the channels of the Gulf of St. Lawrence at depths ranging between 130 and 500 m (70-280 fathoms). Juveniles dominate the Estuary and north of Anticosti.

Spawning takes place primarily in winter, from January to March. Males reach sexual maturity at a smaller size than females, at about 36 cm for males compared to 45 cm for females. This difference helps explain why females grow to be larger than males and make up the majority of commercial catches.

Description of the Fishery

In 2012, the number of active licences was 170 from Quebec and 90 from Newfoundland. The fishery management measures include the imposition of a minimum mesh size of 152 mm (6.0 inches) and a implementation of a small-fish tolerance protocol for commercial catches of 44 cm. Fishermen must also keep a log book, have their catches weighted by a dockside monitoring program and agree to have an observer on board at the Department's request (5% coverage). The fishery opens on May 15 and closes on May 14 of the following year. The fishery has been managed by TAC since 1982. Some fishermen have individual quotas while others are under competitive regime.

Until the mid-1970s, Greenland halibut landings in 4RST consisted mainly of by-catches from other fisheries (Figure 2). Subsequently, a directed gillnet fishery developed and landings fluctuated substantially, exceeding 8,000 t in 1979 and 1987. These peaks were both followed by sharp drops. Catches remained between 2,000 t and 4,000 t from 1989 to 1998. Landings decreased between 1999 and 2001, dropping from 3,600 tons to less than 1,300 tons. Landings increased to 3,900 tons between 2001 and 2004 and have been relatively stable since. TAC was set at 4,500 tons since 2004 and the allocation for the fixed gear directed fishery for Greenland halibut was set at 3,751 t.

In 2011, landings for NAFO Divisions 4RST amounted to 3,811 t for fixed gear and 44 t for mobile gear, for a total of 3,855 t (Table 1). In 2012, preliminary landings by December 31 were 3,515 t for fixed gear and 35 t for mobile gear, for a total of 3,550 t.

Table 1. Landings (thousands of tons)

Year	77-98 mean	1999-2000	2000-2001	2001-2002	2002-2003	2003-2004	2004-2005	2005-2006	2006-2007	2007-2008	2008-2009	2009-2010	2010-2011	2011-2012	2012-2013[1]
TAC	-	4.5[2]	4.5[3]	4.5[3]	3.5[3]	3.5[3]	4.5[3]	4.5[3]	4.5[3]	4.5[3]	4.5[3]	4.5[3]	4.5[3]	4.5[3]	4.5[3]
Fixed gear	3.1	3.4	2.0	1.2	1.6	3.5	3.8	3.8	3.8	3.6	3.7	4.2	3.7	3.8	3.5
Mobile gear	1.1	0.2	0.1	0.1	0.1	0.1	0.1	0.2	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Total	4.2	3.6	2.1	1.3	1.7	3.6	3.9	4.0	3.9	3.7	3.8	4.3	3.8	3.9	3.6

[1] *Preliminary data*
[2] *TAC from January 1, 1999 to May 14, 2000*
[3] *TAC from May 15 to May 14*

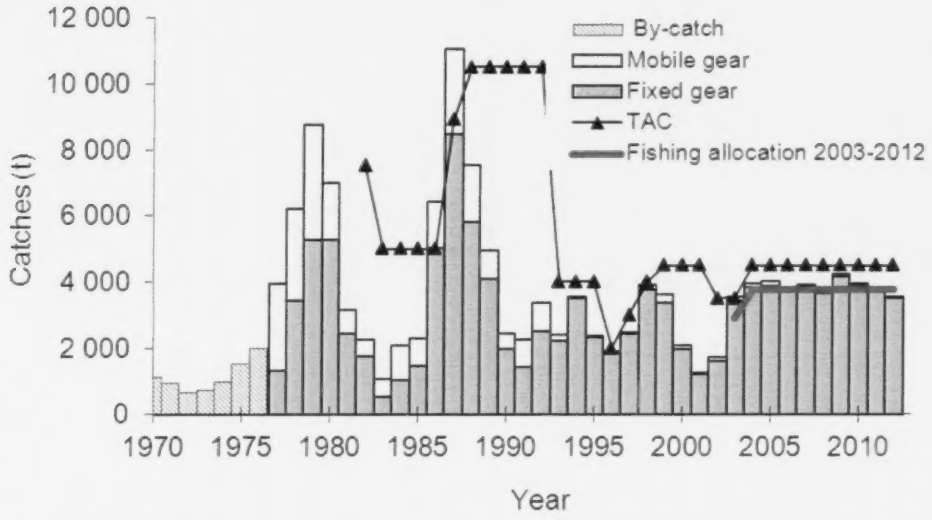

Figure 2. Greenland halibut landings and total allowable catch (TAC) since 1970. Data for 2012 are preliminary. The 3,751 t allocation to fixed gear is also highlighted (Blue dark line).

RESOURCE ASSESSMENT

The assessment of the Greenland halibut stock is mostly based on analysis of commercial fishery data and from research surveys. The fishery data come from three different sources of information; purchase slip, fisherman's daily logbook and samples of commercial catches. Two research surveys with trawl were conducted annually in the northern Gulf. The first one in August with a DFO vessel and the second in July with the Sentinel program. During sampling of commercial and survey catches, the fish are sexed. In addition, data on sexual maturity of males and females and the condition of the fish are collected during the DFO survey.

Biological Data

The size at maturity for Greenland halibut has considerably dropped between 1996 and 2001 and has remained generally below the average after that (Figure 3A). The size at 50% of maturity dropped from 40 cm to 36 cm and from 50 cm to 45 cm for males and females respectively. The size at maturity for males is considerably lower than the minimum size of 44 cm established for the small fish protocol. Moreover, the proportion of mature individuals at length indicates that at 44 cm, 63% of females and 2% of males are immature. Because the growth rate drops after reaching sexual maturity, there exists a size dimorphism between males and females that increases the proportion of females in commercial catches.

The mean size of turbot caught was around 43 cm in 1995, and rose to 48 cm in 1996 following the mesh size increase from 140 mm (5.5 in) to 152 mm (6.0 in) (Figure 3B). The mean size of fish caught has increased from 2002 to reach the maximum of the series in 2011 and 2012 at 49.5 cm. Overall, the percentage of fish landed that were smaller than 44 cm has decreased from 25% in 2005 at below 10% since 2010. This diminution has been observed in each NAFO divisions from 2006 to 2012. The proportion of females in the fishery declined from 85% to 73%

from 2009 to 2012. This change is due to an increase of fishing effort in Esquiman, sector where males represented 45% of the catch in 2012.

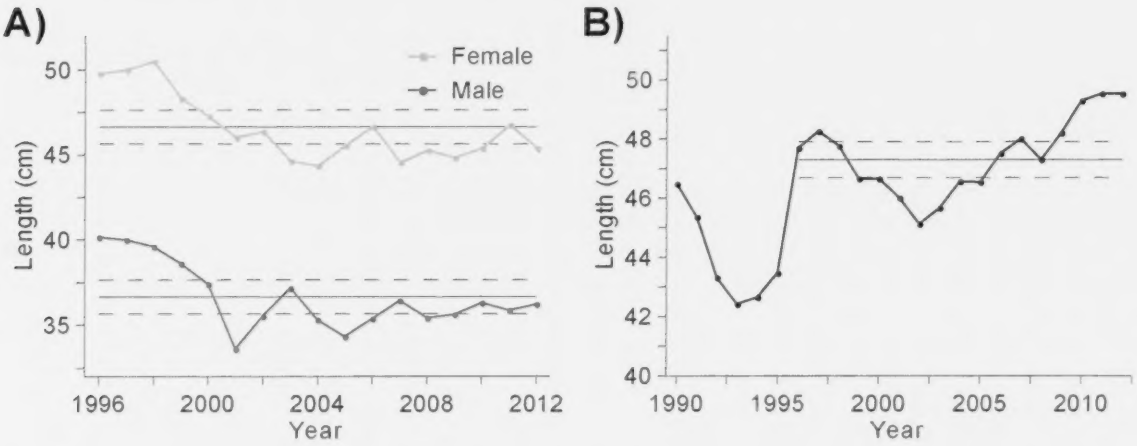

Figure 3. Size at 50% maturity for fish caught in the DFO research survey (A) and mean length of fish caught in gillnets commercial catches (B). The horizontal lines indicate the mean of the series (solid line) ± 0.5 standard deviation (dashed lines).

Commercial Fishery Performance

The commercial catch rate is used as an index of fishery performance and not as an index of abundance of exploitable stock. This index is standardized to account for changes based on NAFO subarea, soak time and seasonal pattern.

Commercial catch rates in 4RST in 2011 and 2012 were comparable to the series average but lower than those seen between 2007 and 2010 (Figure 4). A decline was observed in the western Gulf with values below the series mean in 2011 and 2012. A decline was also observed in Esquiman in 2012 although the catch rate remained high. Finally, catch rates are comparable in the north of Anticosti since 2006.

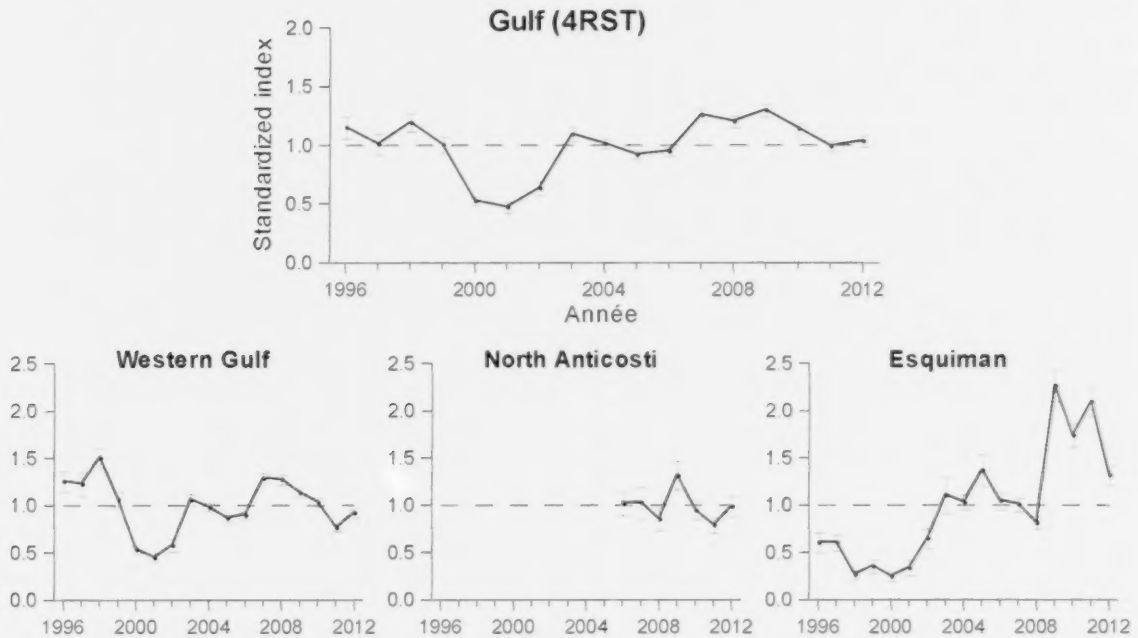

Figure 4. Standardized fishery indices for the Gulf (4RST) and per fishing regions. The horizontal line indicates the mean of the series.

Abundance Index

The biomass index from the DFO survey has remained stable and above the series mean but has declined slightly since 2007 (Figure 5). The biomass index from the Sentinel survey has been constantly declining since 2007 and is below the series average in 2011 and 2012.

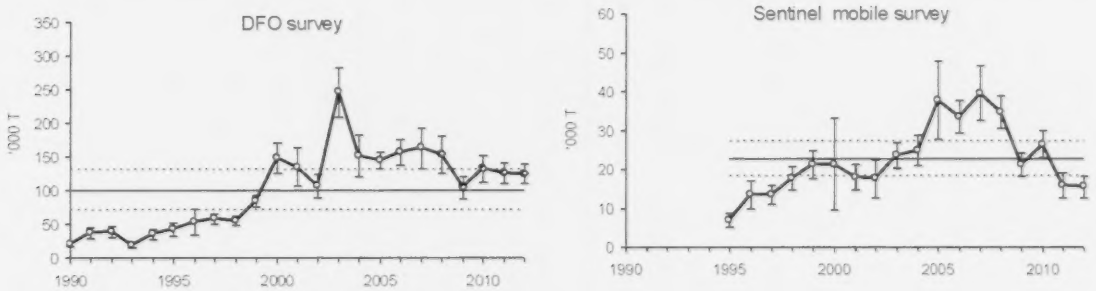

Figure 5. Minimum trawlable biomass indices estimated from the DFO research survey and the July Sentinel mobile survey. The horizontal lines indicate the mean of the series (solid line) ± 0.5 standard deviation (dashed lines).

Abundance indices of pre-recruits and of recruited fish (44 cm and over) estimated from DFO survey are above the series mean since 2003 (Figure 6). They show a slight increase since 2009 but are below the values observed between 2003 and 2007. The index of abundance of

juveniles (<30 cm) is variable and generally higher than the average since 1998 and the index for fish between 30 to 39 cm is comparable to the average in 2011 and 2012. Abundance indices for the different size categories from the Sentinel have been decreasing since 2007 and are below the series mean in 2011 and 2012 (Figure 6).

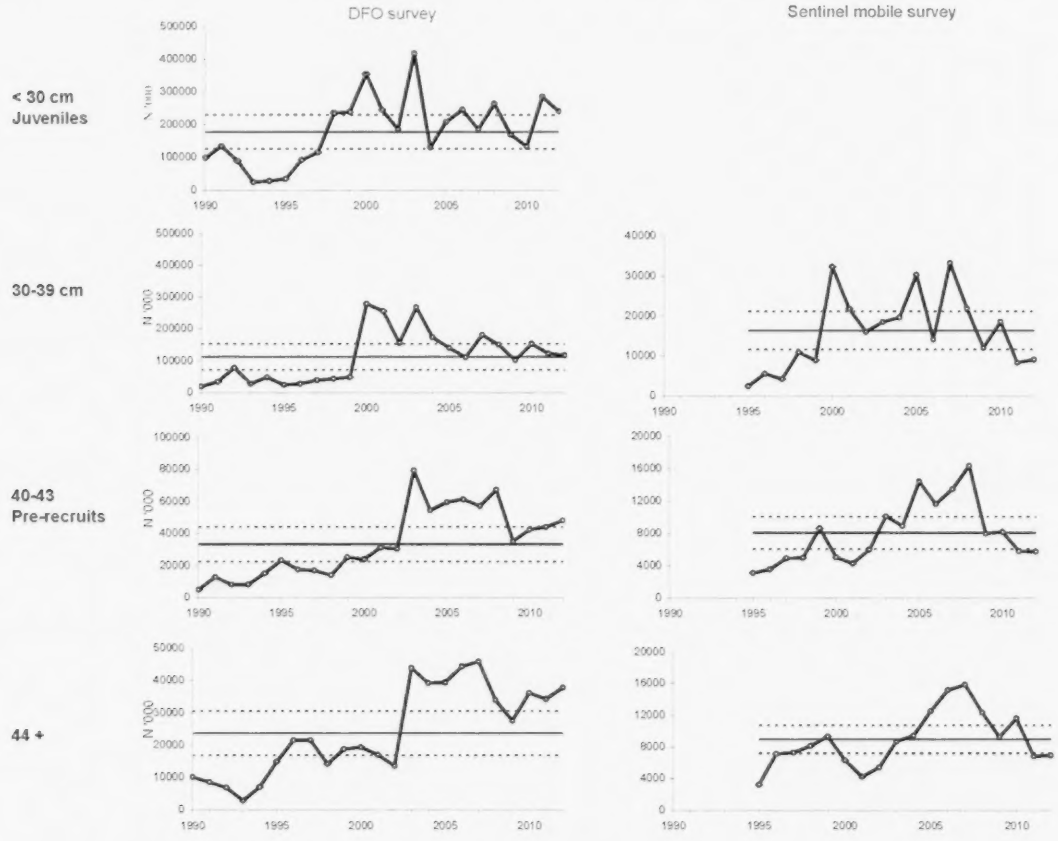

Figure 6. Abundance indices for pre-recruits of various sizes (cm) and fish available to the fishery (44 +) estimated for the DFO research survey and the July Sentinel mobile survey. The horizontal lines indicate the mean of the series (solid line) ± 0.5 standard deviation (dashed lines).

Perspectives

Juvenile abundance varies a lot from one year to the next, and they are recruited to the fishery around the age of 5. The strength of these annual year-classes, their growth, as well as environmental conditions influence stock abundance. These fluctuations of stock abundance have an impact on the fishery's success.

Recruitment of the two very abundant year-classes of 1997 and 1999 (Figure 7) resulted in the abundance index increases observed in the early 2000s. Prior to the arrival of these year-classes, indices were at a low level. Subsequently, the fishery has targeted new and less abundant year-classes (2001 and 2002) than the 1997 and 1999 year-classes but that represent nonetheless two considerably abundant year-classes. Year-classes that should

contribute to the fishery in 2013 and 2014 are of average abundance and should maintain current catch level. The strong 2010 year-class, the third stronger since 1990, will start getting recruited to the fishery in 2015 and should dominate the fishery in 2016.

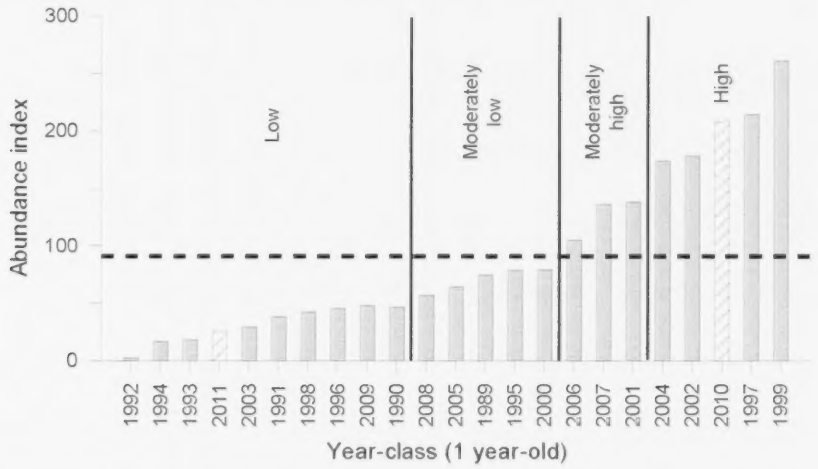

Figure 7. Recruitment index measured for each cohort at age 1 on the DFO research survey from 1990 to 2012. Recruitment strength is split into four categories. The dotted line represents the average 1990-2012.

Sources of Uncertainty

Fishing sites have changed since 2006. During this period, fishing activities have dropped in the Estuary and fisheries have developed around Anticosti (southwest and north). Since 2011, there is no more fishing in southwest Anticosti and there has been a large increase in Esquiman. The proportion of catches in the western Gulf has declined from 68% to 37% from 2007 to 2012 while it has increased from 28% to 49% in Esquiman. Industry representatives indicated that a shift in effort towards Esquiman was necessary in this area to achieve acceptable yields. It could be difficult for fishermen to maintain high catch rates after a few years of fishing in Esquiman.

The new divergence in the abundance trends between the DFO and the Sentinel surveys remains a concern. The DFO survey indicates a stability of the resource while the mobile Sentinel shows a decline of it.

The size at sexual maturity remained low and below the series mean. This indicator remains a concern for the preservation of the spawning stock. The low condition of turbot observed in 2012 is also of concern.

CONCLUSIONS AND ADVICE

The indicators from fisheries and DFO research survey show that the stock status is greater than or equal to the historical average. Catches in 2011 and 2012 seasons were dominated by fish from the strong 2004 year-class, which has contributed to the increase in the average size in the catch. Year-classes that should contribute to the fishery in 2013 and 2014 are of average abundance and should maintain current catch level. A strong 2010 year-class will start

recruiting to the fishery in 2015 and should dominate the fishery in 2016. Given that the main resource status indices indicate some stability in the fishery, it is recommended that the status quo be maintained in terms of authorized catch levels for 2013-2014 and 2014-2015.

OTHER CONSIDERATIONS

The shrimp fishery is carried out using small-meshed trawls that catch and retain several fish and marine invertebrate species. Although large fish are released from trawls due to the mandatory use of a separator grate, catches still contain a certain number of small specimens. Greenland halibut by-catches from the shrimp fishery from 2000 to 2011 were examined using the observers at sea database. Greenland halibut were present on average in 90% of the activities observed. Greenland halibut by-catches are mostly of the order of 3 kg or less per tow and are mostly made up of 1 year-old individuals, and in a lesser extent 2 year-old individuals. The average annual Greenland halibut by-catches from the shrimp fishery in the Estuary and Gulf from 2000 to 2011 are around 86 tons. In 2011, there were estimated at 83 t of Greenland halibut, representing approximately 0.41% of the estimated biomass of small turbot from the DFO survey.

SOURCES OF INFORMATION

This Science Advisory Report is from the meeting of February 26, 2013 on the Assessment of Greenland halibut in the Gulf of St. Lawrence (4RST). Additional publications from this meeting will be posted on the Fisheries and Oceans Canada (DFO) Science Advisory Schedule as they become available.

Archambault, D., Bourdages, H., Bernier, B., Galbraith, P., Gauthier, J., Grégoire, F., Lambert, J. and Savard, L. 2013. Preliminary results from the groundfish and shrimp multidisciplinary survey in August 2012 in the Estuary and northern Gulf of St. Lawrence. DFO Can. Sci. Advis. Sec. Res. Doc. 2012/144. iv + 107 p.

Bernier, B. and Chabot, D. 2012. Assessment of Greenland Halibut (*Reinhardtius hippoglossoides*) stock status in the Gulf of St. Lawrence (4RST) in 2010 and diet description for this population. DFO Can. Sci. Advis. Sec. Res. Doc. 2012/140, 93 p.

DFO. 2013. Importance of bycatch in the northern shrimp fishery in the Estuary and northern Gulf of St. Lawrence. DFO Can. Sci. Advis. Sec. Sci. Advis. Rep. 2012/066.

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